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Flexible cellular polymeric materials — Sponge and expanded cellular rubber products — Specification —

Part 1: Sheeting

*Polymères alvéolaires souples — Caoutchoucs alvéolaires mousses et
souples — Spécification —*

Partie 1: Feuille



Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 6916-1 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*.

ISO 6916 consists of the following parts, under the general title *Flexible cellular polymeric materials — Sponge and expanded cellular rubber products — Specification*:

- *Part 1: Sheetting*
- *Part 2: Mouldings and extrusions*

Annexes A to G form an integral part of this part of ISO 6916.

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Flexible cellular polymeric materials — Sponge and expanded cellular rubber products — Specification —

Part 1: Sheeting

1 Scope

1.1 This part of ISO 6916 classifies flexible cellular rubber products known as sponge and expanded rubber. The base material used in their manufacture may be natural rubber, reclaimed rubber or synthetic rubber, either alone or in combination. The only products included in this part of ISO 6916 are in the form of sheeting.

1.2 This part of ISO 6916 does not apply to latex foam rubbers, shoe soling or other similar micro-cellular products, ebonite cellular rubbers, virgin or reconstituted flexible, semi-rigid urethane foams, virgin or reconstituted poly(vinyl chloride), or poly(vinyl chloride) blended with other polymers.

1.3 Two types are specified, as follows:

Type 1: open-cell rubber (normally known as sponge rubber).

Type 2: closed-cell rubber (normally known as expanded rubber)

These types are further classified by division into classes, based on their relative resistance to the action of petroleum-based oils and/or temperature resistance, and grades, based on a specific range of compression-deflection requirements. The product can be further classified by the addition of a suffix letter to the type, class and grade designation to indicate additional requirements. This letter is then defined by a suffix number denoting a test method.

1.4 Attention is drawn to the fact that most extruded or moulded shapes are of sizes too small for cutting standard test pieces. These are difficult to classify and

test by the methods given in this part of ISO 6916 and cannot, therefore, be tested using these procedures.

In the case of conflict between the provisions of this part of ISO 6916 and those of the detailed specification or test method for a particular product, the latter shall take precedence. Reference to the methods shall specifically state the desired test or tests.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 6916. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 6916 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 188:1982, *Rubber, vulcanized — Accelerated ageing or heat-resistance tests*.

ISO 471:1995, *Rubber — Times temperatures and humidities for conditioning and testing*.

ISO 815:1991, *Rubber, vulcanized or thermoplastic — Determination of compression set at ambient, elevated or low temperatures*.

ISO 1431-1:1989, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static strain test*.

ISO 1817:1985, *Rubber, vulcanized — Determination of the effect of liquids*.

ISO 1923:1981, *Cellular plastics and rubbers — Determination of linear dimensions*.

ISO 3865:1983, *Rubber, vulcanized — Methods of test for staining in contact with organic material*.

ISO 5893:1993, *Rubber and plastics test equipment — Tensile, flexural and compression types (constant rate of traverse) — Description*.

NOTE 1 In some of the test methods referenced above, the apparatus, but not procedure, is used.

3 Classification (types, classes, grades and suffixes)

3.1 Types

This part of ISO 6916 covers two types of cellular rubber, as follows:

Type 1: open-cell rubber.

Type 2: closed-cell rubber.

3.2 Classes

Each type is divided into four classes designated by the letters A, B, C and D (for example type 1B).

Class A: Cellular rubbers made from natural rubber, reclaimed rubber or synthetic rubber alone or in combination, where specific resistance to the action of petroleum-based oils is not required.

Class B: Cellular rubbers made from synthetic rubber having specific requirements for oil resistance with low swell.

Class C: Cellular rubbers made from synthetic rubber having specific requirements for oil resistance with medium swell.

Class D: Cellular rubbers made from synthetic rubber having specific requirements for both low and high temperature resistance (−75 °C to 250 °C) but where specific resistance to the action of petroleum-based oils is not required.

3.3 Grades

Each class is divided into six different grades based on a specific range of firmness as expressed by compression deflection. Grades are designated by a digit (0 to 6), with the softer grades being identified with the lower numbers and the harder grades with the higher numbers.

Grade 0: for type 1 cellular rubbers only, a compression-deflection range of 2,5 kPa to 15 kPa.

Grade 1: for type 1 and 2 cellular rubbers, a compression-deflection range of 15,1 kPa to 35 kPa.

Grade 2: for type 1 and 2 cellular rubbers, a compression-deflection range of 35,1 kPa to 65 kPa.

Grade 3: for type 1 and 2 cellular rubbers, a compression-deflection range of 65,1 kPa to 95 kPa.

Grade 4: for type 1 and 2 cellular rubbers, a compression-deflection range of 95,1 kPa to 125 kPa.

Grade 5: for type 1 and 2 cellular rubbers, a compression-deflection range of 125,1 kPa to 200 kPa.

Grade 6: for type 1 and 2 cellular rubbers, a compression-deflection range of 200,1 kPa to 300 kPa.

3.4 Suffix letters

Suffix letters may be added singly or in combination after any grade number to indicate additional requirements beyond those specified in tables 1 and 2 as basic requirements. The significance of the approved suffix letters is shown in table 3.

3.5 Suffix numbers

Each suffix letter should preferably be followed by one suffix number. The suffix number always indicates the test method. The time of test is part of the method and is taken from the listing in table 4.

NOTE 2 Examples of codings:

- a) 1A2C1F1: This is an open-cell, non-oil-resistant material, firmness 35,1 kPa to 65 kPa, compression set at basic level, ozone-resistant to 25 pphm, and low-temperature-resistant to −40 °C.
- b) 1C3B1C1F2: This is an open-cell material, oil-resistant at the medium swell level, firmness 65,1 kPa to 95 kPa, compression set 25 % max., ozone-resistant to 25 pphm, and low-temperature-resistant to −55 °C.

4 Material and workmanship

4.1 Cellular rubbers produced to this part of ISO 6916 shall be manufactured from natural rubber, synthetic rubber or reclaimed rubber, together with added compounding ingredients of such nature and quality that the product complies with the specification requirements.

4.2 In permitting choice in the use of materials, it is not intended to imply that the resulting different

rubber materials are equivalent in respect of all physical properties. Any special characteristics other than those specified in this part of ISO 6916 which may be desired for a specific application shall be detailed in the particular product specification. All materials and workmanship shall be in accordance with good com-

mercial practice, and the resulting cellular rubbers shall be free from defects affecting serviceability.

These products shall also conform with national and supranational health and safety regulations.

Table 1 — Physical requirements for cellular rubbers, type 1, open-cell (sponge) rubber

Basic requirements							
Grade No.	Compression deflection at 25 % Deflection at 23 °C ± 2 °C kPa (Limits)	Compression deflection after conditioning — Change from original value			Compression set under constant deflection of 50 %		Oil resistance 22 h at 70 °C ± 1 °C Change in volume in ISO 1817 petroleum-based oil No. 3 % (Limits)
		168 h at 70 °C ± 1 °C % (Limits)	22 h at 150 °C ± 2 °C % (Limits)	5 h at -55 °C ± 2 °C % (Max.)	22 h at 70 °C ± 1 °C % (Max.)	22 h at 100 °C ± 1 °C % (Max.)	
Class A, non-oil-resistant							
1A0	2,5 to 15	±20 ¹⁾	—	—	25	—	—
1A1	15,1 to 35	±20	—	—	25	—	—
1A2	35,1 to 65	±20	—	—	25	—	—
1A3	65,1 to 95	±20	—	—	25	—	—
1A4	95,1 to 125	±20	—	—	25	—	—
1A5	125,1 to 200	±20	—	—	25	—	—
1A6	200,1 to 300	±20	—	—	25	—	—
Class B, oil-resistant, low-swell							
1B0	2,5 to 15	±20 ¹⁾	—	—	40	—	-25 to +10
1B1	15,1 to 35	±20	—	—	40	—	-25 to +10
1B2	35,1 to 65	±20	—	—	40	—	-25 to +10
1B3	65,1 to 95	±20	—	—	40	—	-25 to +10
1B4	95,1 to 125	±20	—	—	40	—	-25 to +10
1B5	125,1 to 200	±20	—	—	40	—	-25 to +10
1B6	200,1 to 300	±20	—	—	40	—	-25 to +10
Class C, oil-resistant, medium-swell							
1C0	2,5 to 15	±20 ¹⁾	—	—	50	—	+10 to +60
1C1	15,1 to 35	±20	—	—	50	—	+10 to +60
1C2	35,1 to 65	±20	—	—	50	—	+10 to +60
1C3	65,1 to 95	±20	—	—	50	—	+10 to +60
1C4	95,1 to 125	±20	—	—	50	—	+10 to +60
1C5	125,1 to 200	±20	—	—	50	—	+10 to +60
1C6	200,1 to 300	±20	—	—	50	—	+10 to +60
Class D, high-temperature-resistant							
1D0	2,5 to 15	—	±10	5	—	50	—
1D1	15,1 to 35	—	±10	5	—	30	—
1D2	35,1 to 65	—	±10	5	—	30	—
1D3	65,1 to 95	—	±10	5	—	30	—
1D4	95,1 to 125	—	±10	5	—	30	—
1D5	125,1 to 200	—	±10	5	—	30	—
1) If, after ageing, this grade still falls within the compression-deflection requirement of 2,5 kPa to 15 kPa, it shall be considered acceptable even though the change from the original value is greater that ±20 %.							

Table 2 — Physical requirements for cellular rubbers, type 2, closed-cell (expanded) rubber

Basic requirements								
Grade No.	Compression deflection at 25 %	Compression deflection after conditioning — Change from original value			Compression set under constant deflection of 50 %		Water absorption 3 min at 23 °C ± 2 °C	Fluid resistance 168 h at 23 °C ± 2 °C
	Deflection at 23 °C ± 2 °C	22 h at 70 °C ± 1 °C	22 h at 150 °C ± 2 °C	5 h at -55 °C ± 2 °C	22 h at 23 °C ± 2 °C	22 h at 100 °C ± 1 °C	Mass of water uptake	Change in mass in ISO 1817 liquid B
	kPa (Limits)	% (Limits)	% (Limits)	% (Max.)	% (Max.)	% (Max.)	% (Max.) ¹⁾	% (Max.) ²⁾
Class A, non-oil-resistant								
2A1	15,1 to 35	±30	—	—	25	—	5 or 10	—
2A2	35,1 to 65	±30	—	—	25	—	5 or 10	—
2A3	65,1 to 95	±30	—	—	25	—	5 or 10	—
2A4	95,1 to 125	±30	—	—	25	—	5 or 10	—
2A5	125,1 to 200	±30	—	—	25	—	5 or 10	—
2A6	200,1 to 300	±30	—	—	25	—	5 or 10	—
Class B, oil-resistant, low-swell								
2B1	15,1 to 35	±30	—	—	25	—	5 or 10	50
2B2	35,1 to 65	±30	—	—	25	—	5 or 10	50
2B3	65,1 to 95	±30	—	—	25	—	5 or 10	50
2B4	95,1 to 125	±30	—	—	25	—	5 or 10	50
2B5	125,1 to 200	±30	—	—	25	—	5 or 10	50
2B6	200,1 to 300	±30	—	—	25	—	5 or 10	50
Class C, oil-resistant, medium-swell								
2C1	15,1 to 35	±30	—	—	25	—	5 or 10	150
2C2	35,1 to 65	±30	—	—	25	—	5 or 10	150
2C3	65,1 to 95	±30	—	—	25	—	5 or 10	150
2C4	95,1 to 125	±30	—	—	25	—	5 or 10	150
2C5	125,1 to 200	±30	—	—	25	—	5 or 10	150
2C6	200,1 to 300	±30	—	—	25	—	5 or 10	150
Class D, high-temperature-resistant								
2D1	15,1 to 35	—	±5	5	—	80	5 or 10	—
2D2	35,1 to 65	—	±5	5	—	60	5 or 10	—
2D3	65,1 to 95	—	±5	5	—	60	5 or 10	—
2D4	95,1 to 125	—	±5	5	—	60	5 or 10	—
2D5	125,1 to 200	—	±5	5	—	60	5 or 10	—

1) For cellular materials with densities not exceeding 160 kg/m³, the value of water absorption allowed is 10 % max. by mass. For densities greater than 160 kg/m³, the maximum permitted value of water absorption is 5 % by mass.

2) This test (annex F) of mass change in liquid B is used in place of the usual oil resistance test of volume change in No. 3 oil for the following reason. Oil or solvent immersion of flexible closed-cell materials usually causes loss of gas, by diffusion through the softened cell walls, which results in some shrinkage of the test piece. This shrinkage counteracts the swell which would normally occur, thus invalidating test data based on volume change. Liquid B is used because it produces a wider and more consistent differentiation between classes A, B and C than does the No. 3 oil.

Standard oil resistance test methods give inconsistent results on closed-cell materials. This test gives a general indication of oil resistance, but more reliable information should be obtained by testing in actual or simulated service conditions.

The figures of 150 % max. for class C and 50 % max. for class B apply to cellular materials having densities greater than 160 kg/m³. For cellular materials with densities not exceeding 160 kg/m³, the maximum permitted values of mass change are 250 % for class C and 100 % for class B.